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The thesis will be performed at the IBM Research-Zurich in Rüschlikon.

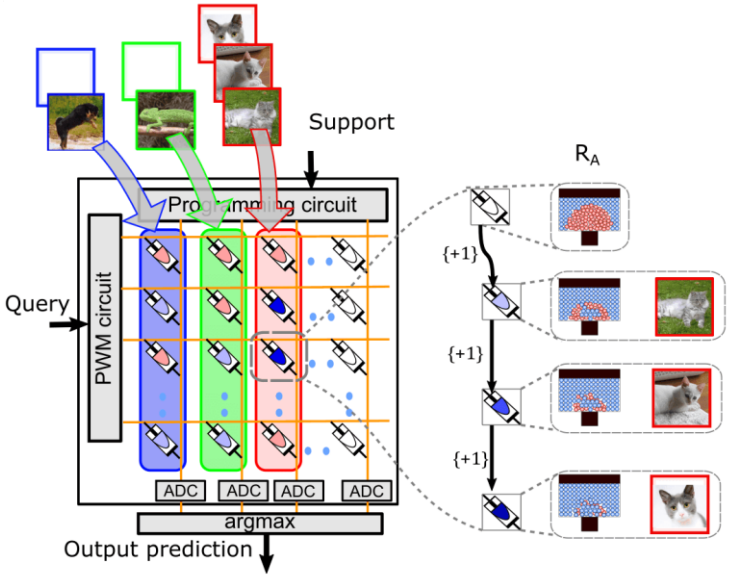
Master Projects

IBM Research –Zurich

Continual and Few-shot Learning

Introduction

Continually learning new classes from fresh data without forgetting previous knowledge of old classes is a very challenging research problem. Moreover, it is imperative that such learning must respect certain memory and computational constraints such as (i) training samples are limited to only a few per class, (ii) the computational cost of learning a novel class remains constant, and (iii) the memory footprint of the model grows at most linearly with the number of classes observed. To meet the above constraints, new methods (see references below) were proposed in which a novel neural architecture is composed of a frozen meta-learned feature extractor, a trainable fixed-size fully connected layer, and a rewritable dynamically growing memory that stores as many vectors as the number of encountered classes.



Goal

In this thesis we explore new and extremely energy-efficient HW/SW methods for few-shot continual learning to scale for a huge number of items emulating the capacity of human visual perception.

Tasks and Type

There are several challenges that need to be overcome at algorithmic (60%) and hardware implementation (40%) levels to realize few-shot continual learning at scale. These include incorporating various losses, models, and including nonidealities during training. We are inviting applications from students to conduct their Master's thesis work on this exciting new topic. The work performed could span high-level algorithmic developments all the way to efficient implementations on emerging in-memory computing platforms. It also involves interactions with several researchers across IBM research focusing on various aspects of the project. The ideal candidate should have a multi-disciplinary background, strong mathematical aptitude and programming skills. Prior knowledge on machine learning and AI is a bonus.

[1] Hersche et al. *CVPR*, 2022. [2] Karunaratne et al. *ESSCIRC*, 2022. [3] YouTube Demo